REMARKS

Reconsideration of this application is respectfully requested in view of the following remarks.

Claims 1-4 are currently pending in the application and are subject to examination.

In the Office Action mailed September 28, 2004, the Examiner rejected claims 1-4 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the invention. The Applicants hereby traverse the rejection, as follows.

The Office Action states that the recitation of the high-elasticity base material as having an "upper range" Poisson ratio and Young's modulus in claim 1 is indefinite because it is not known what values applicant would consider "upper range." The Office Action also states that the applicant does not specify how close to 0.5 a Poisson ratio must be to qualify as "upper range" and, therefore, it is not possible to ascertain the metes and bounds of the claim. *See* Office Action, at pages 2-3.

With regards to claim 1, it is respectfully submitted that one of ordinary skill in the art would recognize that a "material having an upper range Poisson ratio," as recited in claim 1, would encompass any elastomer having a Poisson's ratio approaching 0.5. As stated in the Applicants' response filed on June 21, 2004, the Poisson ratio is always between 0.0 and 0.5 for materials having isotropic mechanical properties. Given this fact, it is respectfully submitted that it is well known in the art that materials with a Poisson ratio approaching the "upper range" of 0.5 are almost incompressible materials that retain their volume regardless of the applied stress. This is evidenced, for example,

by the disclosure in U.S. Patent No. 6,799,000 to Aslam, et al., which recites in relevant part:

> A compliant fuser roller may include a conformable layer of any useful material, such as for example **a substantially incompressible elastomer, i.e., having a Poisson's ratio approaching 0.5.**

See U.S. Patent No. 6,799,000, column 2, lines 42-45 (emphasis added).

Additional evidence may be found, for example, in U.S. Patent No. 6,649,115 to Weiss, et al., which recites in relevant part:

> The tension causes the interstitial **elastomer** to substantially contract vertically as it is pulled laterally, **due to its relatively high Poisson's ratio v.**

See U.S. Patent No. 6,649,115 column 3, lines 48-50 (emphasis added).

Yet further evidence may be found, for example, in the Glossary Of Materials Attributes, which defines a Poisson ratio as:

> [T]he negative of the ratio of the lateral strain to uniaxial strain, in axial loading. Its value for many solids, is close to 1/3. **For elastomers it is just under 0.5.**

See www.grantadesign.com/resources/materials/glossary.htm (emphasis added).

Copies of each of the above are attached as Exhibits for the Examiner's convenience.

Based on the above examples, the Applicants respectfully submit that it is known in the art that materials "having an upper range Poisson ratio," are elastomers having a Poisson's ratio close to 0.5. Therefore, the limitation of claim 1 of a "material having an upper range Poisson ratio" has an agreed upon meaning in the art, which is "a Poisson's ratio approaching 0.5" or a "high" Poisson's ratio, or a Poisson's ratio "just

under 0.5."

With respect to the "upper range" Young's modulus, the Applicants respectfully submit that description in paragraph 0027 of the specification, that "a suitable base material has Young's modulus of thousands psi," is sufficient to describe the "upper range" of Young's modulus, as recited in claim 1.

Accordingly, the Applicants respectfully submit that the "upper range" limitation, as recited in claim 1, is sufficient to particularly point out and distinctly claim the subject matter which the Applicant regards as his invention. For at least these reasons, the Applicants submit that claim 1 is in compliance with 35 U.S.C. § 112, and respectfully request the withdrawal of the rejection. As claim 1, is allowable, Applicants submit that claims 2-4, each of which depends from allowable claim 1, are likewise allowable over the cited prior art.

For all of the above reasons, it is respectfully submitted that the claims now pending particularly point out and distinctly claim the invention. Accordingly, reconsideration and withdrawal of the outstanding rejection and an issuance of a Notice of Allowance are earnestly solicited.

Should the Examiner determine that any further action is necessary to place this application into better form, the Examiner is encouraged to telephone the undersigned representative at the number listed below.

In the event this paper is not considered to be timely filed, the Applicants hereby petition for an appropriate extension of time. The Commissioner is hereby authorized to charge any fee deficiency or credit any overpayment associated with this communication to Deposit Account No. 01-2300, referring to client-matter number 107156-00101.

Respectfully submitted,

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Enclosures:	Exhibit A:	U.S. Patent No. 6,799,000 to Aslam, et al.
	Exhibit B:	U.S. Patent No. 6,649,115 to Weiss, et al.
	Exhibit C:	Glossary Of Materials Attributes, www.grantadesign.com/resources/materials/glossary.htm

EXHIBIT A

U.S. Patent No. 6,799,000 to Aslam, et al.

EXHIBIT B

U.S. Patent No. 6,649,115 to Weiss, et al.

EXHIBIT C

Glossary Of Materials Attributes

www.grantadesign.com/resources/materials/glossary.htm

Shear Modulus

Units: SI: GPa; cgs: 10^{10}dyne/cm^2; Imperial: 10^6psi

The shear modulus is the initial, linear elastic slope of the stress-strain curve in shear. For isotropic materials it is related to Young's modulus E and to the bulk modulus K and Poisson's ratio by

$$G = \frac{E}{2(1+\nu)}$$

$$G = \frac{3(1-2\nu)}{2(1+\nu)}K$$

When $\nu = 1/3$, G = (3/8)E, and G = (3/8)K.

Poissons Ratio

Units: Dimensionless

Poisson's ratio ν is the negative of the ratio of the lateral strain to uniaxial strain, in axial loading. Its value for many solids, is close to 1/3. For elastomers it is just under 0.5.

Elastic Limit/Yield Strength

Units: SI: MPa; cgs: 10^7dyne/cm^2; Imperial: 10^3psi

The 'elastic limit' σ_{el}, of a solid requires careful definition.

For metals, the elastic limit is defined as the 0.2% offset yield strength. This represents the stress at which the stress-strain curve for uniaxial tensile loading deviates by a strain of 0.2% from the linear-elastic line. It is the same in tension and compression. It is the stress at which dislocations move large distance through the crystals of the metal.

For polymers, the elastic limit is the stress at which the uniaxial stress-strain curve becomes

markedly non-linear: typically, a strain of 1%. This may be caused by 'shear yielding' (irreversible slipping of molecular chains) or by 'crazing' (formation of low density, crack-like volumes which scatter light, making the polymer look white).

For fine ceramics and glasses, the database entry for the elastic limit is an estimate, based on the tensile strength (which is low due to brittle fracture). When based on direct measurements at high pressures, or on hardness measurements, of the stress required to cause plastic flow, it is very high: higher than the compressive strength, which is lowered by crushing.

For composites, the elastic limit is best defined by a set deviation from linear-elastic uniaxial behaviour: 0.5% is taken in the database.

Elastic limit depends on the mode of loading. For modes of loading other than uniaxial tension, such as shear and multiaxial loading, the strength is related to that in simple tension by a yield function. For metals, the Von Mises yield function works well. It specifies the relationship between the principal stresses $\sigma 1$, $\sigma 2$, $\sigma 3$ and the yield strength σy (elastic limit):

$$(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2 = 2\sigma_y^2$$

The Tresca function is sometimes more convenient, because it is less complicated:

$$\sigma_1 - \sigma_3 = \sigma_y\left(1 + \beta\frac{p}{\sigma_y}\right),$$

$$p = -\frac{1}{3}(\sigma_{11} + \sigma_{22} + \sigma_{33}),$$

$\sigma_y =$ yield stress in uniaxial tension, $\beta =$ constant

For ceramics, a Coulomb flow law is used:

$$\sigma_1 - B\sigma_3 = C$$

Tensile Strength

Units: SI: MPa; cgs: 10^7dyne/cm^2; Imperial: 10^3psi

The Tensile strength is the nominal stress at which a round bar of the material, loaded in tension separates. For brittle solids: ceramics, glasses and brittle polymers - it is much less than the compressive elastic limit. For metals, ductile polymers and most composites - it is larger than the yield strength by a factor ranging from 1.1 to 3.

Compressive Strength

Units: SI: MPa; cgs: 10^7dyne/cm^2; Imperial: 10^3psi

For metals, the compressive strength is the same as the tensile yield strength.

Polymers are approximately 20% stronger in compression than in tension.

In Ceramics, compressive strength σc is governed by crushing and is much larger than the tensile strength σt. Typically

$$\sigma_f^c \approx 12\ \sigma_f^t$$

Composites which contain fibres (including natural composites like wood) are a little weaker (up to 30%) in compression than tension because the fibres buckle.

Ductility

Units: Dimensionless (strain)

The tensile ductility is the permanent increase in length of a tensile specimen before fracture, expressed as a fraction of the original gauge length.

Hardness

Units: SI: MPa; cgs: 10^7dyne/cm^2; Imperial: 10^3psi

The hardness of a material is measured by pressing a pointed diamond or hardened steel ball into its surface. The hardness H is defined as the indenter force divided by the projected area of the indent. It can be shown that the hardness is related to the yield strength σ_y of ductile materials by

$H = 3\,\sigma_y$.

Many ceramics, and even glasses, are ductile under small indents, allowing the yield strength in compression (elastic limit) to be inferred from hardness tests.

Modulus of Rupture

Units: SI: MPa; cgs: 10^7dyne/cm^2; Imperial: 10^3psi

When the material is difficult to grip (as is a ceramic), its strength can be measured in bending. The modulus of rupture (MOR) is the maximum surface stress in a bent beam at the instant of failure. One might expect this to be exactly the same as the strength measured in tension, but it is always larger (by a factor of about 1.3) because the volume subjected to this maximum stress is small, and the probability of a large flaw lying in the highly stressed region is also small. (In tension all flaws see the maximum stress.)

The MOR strictly only applies to brittle materials. For ductile materials, the MOR entry in the database is the ultimate strength.

Fracture Toughness

Units: SI: MPa.m$^{1/2}$; cgs: 10^8 dyne/cm$^{3/2}$; Imperial ksi.in$^{1/2}$

The fracture toughness K_c, is a measure of the resistance of a material to the propagation of a crack. It can be measured by loading a sample containing a deliberately-introduced crack of length 2c and then recording the tensile stress σ at which the crack propagates. Fracture toughness is then calculated from

$$K_c = Y \frac{\sigma}{\sqrt{\pi c}}$$

where Y is a geometric factor, near unity, which depends on details of the sample geometry. Measured in this way, K_C has well defined values for brittle materials (ceramic, glasses, many polymers and low toughness metals like cast iron).

In ductile materials, a plastic zone develops at the crack tip, which introduces new features into the way cracks propagate. This necessitates more complex characterisation. Nevertheless, values for K_C are cited and are useful as a way of ranking materials.

Endurance Limit

Units: SI: MPa; cgs: 10^7dyne/cm^2; Imperial: 10^3psi

The endurance limit is defined as the maximum applied cyclic stress amplitude for an 'infinite' fatigue life. Generally 'infinite' life means more than 10^7 cycles to failure.

Loss-Coefficient

Units: Dimensionless

The loss-coefficient measures the degree to which a material dissipates vibrational energy. If a material is loaded elastically to a stress σ_{max}, it stores elastic energy

$$u = \int_0^{\sigma_{max}} d\varepsilon \; \frac{1}{2} \frac{\sigma_{max}^2}{E}$$

per unit volume. If it is loaded and then unloaded, it dissipates energy equivalent to the area of the stress-strain hysteresis loop:

$$\Delta u = \oint \sigma \, d\varepsilon$$

The loss coefficient η is defined as

$$\eta = \frac{\Delta u}{2\pi u}$$

The cycle can be applied in many different ways - some fast, some slow. The value of η usually depends on the time-scale or frequency of cycling.

Temperatures

Units: SI: K; cgs: K; Imperial: °R

The Melting temperature, Tm
The temperature at which a material turns suddenly from solid to liquid. The melting temperature of an alloy is usually less than the melting temperature of the parent metals.

The Glass temperature, Tg
A property of non-crystalline solids which do not have a sharp melting point. It characterises the transition from true solid to viscous liquid in these materials.

Thermal Conductivity

Units: SI: W/m.K; cgs: cal/cm.s.K; Imperial: Btu/h.ft.F

The rate at which heat is conducted through a solid at 'steady state' (meaning that the temperature profile does not change with time) is governed by the thermal conductivity λ. It is measured by recording the heat flux J (W/m^2) flowing from surface at temperature T1 to one at T2 in the material, separated by a distance X:

$$J = \lambda \frac{(T_1 - T_2)}{X}$$

In practice, the measurement is not easy (particularly for materials with low conductivities), but reliable data are now generally available.

Specific Heat

Units: SI: J/kg.K; cgs: cal/g.K; Imperial: Btu/lb.F

Cp is the specific heat capacity at constant pressure. It specifies the amount of heat required to raise the temperature of 1 kg of material by 1°C (K). It is measured by the standard technique of calorimetry.

Thermal Expansion Coefficient

Units: SI: 10^{-6}/K; cgs: 10^{-6}/K; Imperial: 10^{-6}/F

Most materials expand when they are heated. The linear thermal expansion coefficient α is the thermal strain per degree K.

If the material is thermally isotropic, the volumetric expansion per degree is 3α. If it is anisotropic, two or more coefficients are required and the volumetric expansion is the sum of the principal thermal strains.

Latent Heat of Fusion

Units: SI: kJ/kg; cgs: cal/g; Imperial: Btu/lb

The latent heat of fusion, Lm, is the heat absorbed by a crystalline solid on melting; the heat is absorbed at constant temperature (the melting temperature), Tm. Amorphous solids (including many polymers) do not have a sharp melting point. When these pass from a solid state to one which is fluid they do so over a wide temperature range, centred roughly about the glass temperature Tg. It is then not appropriate to define a latent heat of melting.

Resistivity

Units: SI: $10^{-8}\Omega$.m; cgs: $10^{-6}\Omega$.cm; Imperial: $10^{-8}\Omega$.m

The resistivity R is the resistance of a unit cube with unit potential difference between a pair of faces.

It varies over an immense range: from a little more than 1 in units of $10^{-8}\Omega$.m (which are the same as $\mu\Omega$cm) for good conductors, to more than 10^{24} in the same units, for the best insulators.

Dielectric Constant

Units: Dimensionless

When a material (such as that used in a capacitor) is placed in an electric field, it becomes polarised and charges appear at its surfaces which tend to screen the interior from the external field. The tendency to polarise is measured by the dielectric constant.

Power Factor

Units: Dimensionless

Polarisation involves the movement of charged particles (electrons, ions or molecules which carry a dipole moment). In an oscillating external field, the charged particles move between two alternative configurations, and in doing so they dissipate energy. The energy lost in this way is measured by the power factor, which, for our purposes, can be thought of as the dielectric constant times the 'loss tangent'.

Breakdown Potential

Units: SI: 10^6 V/m; cgs: V/cm; Imperial: V/mil

If the potential gradient becomes too steep, normal conduction is replaced by electrical breakdown: a catastrophic electron-cascade, usually causing permanent damage. The breakdown potential-gradient is the material property that characterises this effect.

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GLOSSARY OF MATERIALS ATTRIBUTES

Density

Units: SI: Mg/m^3; cgs: g/cm^3; Imperial: lb/ft^3

The density is the weight per unit volume. We measure it today as Archimedes did: by weighing the material in air and in a fluid of known density.

Atomic Volume

Units: SI: $m^3/kmol$; cgs: $10^6 cm^3/kmol$; Imperial: $in^3/kmol$

The atomic (or molecular) volume Vm is the average volume per 10^3N0 of atoms in the structure, where N0 is Avogadro's number (6.022×10^{23}/mol). For a pure element, it is simply:

$$V_m = \frac{A}{\rho}$$

where A is the atomic weight in kg/kmol and ρ is the density in kg/m^3. For compounds the average

atomic volume is

$$V_m = \frac{M}{n\rho}$$

where M is the molecular weight and n is the number of atoms in the molecule. Thus for a compound with the formula AxBy it is

$$V_m = \frac{xA_A + yA_B}{(x + y)\rho}$$

where AA is the atomic weight of element A, and AB is the atomic weight of element B. For a polymer (CxHyOz)n it is therefore

$$V_m = \frac{XA_C + YA_H + ZA_O}{(X + Y + Z)\rho}$$

where AC is the atomic weight of carbon, and so on. The atomic volume is involved in many property correlations (and thus is crucial for checking and estimating properties) and, together with the density, it gives the atomic weight.

Energy Content

Units: SI: MJ/kg; cgs: kcal/g; Imperial: kcal/lb

The energy content of a material is an approximate estimate of the energy used to make it from its naturally-occurring ores, feed stocks or sources, plus the energy content of the source material itself. (Usually the energy content of the source material is small, except, for example, when the source is oil.) Thus the energy content of Aluminium is dominated by the electric power absorbed in its extraction from Bauxite; that for polymers, for which the feed stock is crude oil is the energy contained in the oil itself plus that of the subsequent processing; and that for wood is the energy content of wood plus the energy required to harvest it.

Young's Modulus

Units: SI: GPa; cgs: 10^{10}dyne/cm^2; Imperial: 10^6psi

Young's modulus, E, is the slope of the initial, linear-elastic part of the stress-strain curve in tension or compression. For isotropic materials it is related to the bulk modulus K and to the shear modulus G by

$$E = 3(1 - 2\nu)K$$
$$E = 2(1 + \nu)G$$

where ν is Poisson's ratio. Commonly ν = 1/3, and hence E = K, and E = (8/3)G.

Bulk Modulus

Units: SI: GPa; cgs: 10^{10}dyne/cm^2; Imperial: 10^6psi

The bulk modulus, K, measures the elastic response to hydrostatic pressure, p:

$$K = v\frac{dp}{dv}$$

where v is the volume. For isotropic solids it is related to Young's modulus E and to the shear modulus G by

$$K = \frac{E}{3(1 - 2\nu)}$$
$$K = \frac{2(1 + \nu)}{3(1 - 2\nu)}G$$

where ν is Poisson's ratio. When ν = 1/3, E = K, and K = (8/3)G.